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QXpander™ processor
QX2130FS / QX2130S

The QX pander chip (QX-2000 Series) is a sound enhancement sound processor based on QSOUND's QX pander™ technology, and produces virtual 3D sound from ordinary audio signals. This IC requires no special encoding of input signals or additional speakers, and so simplifies the development of high-value-added personal computers, televisions and audio products.

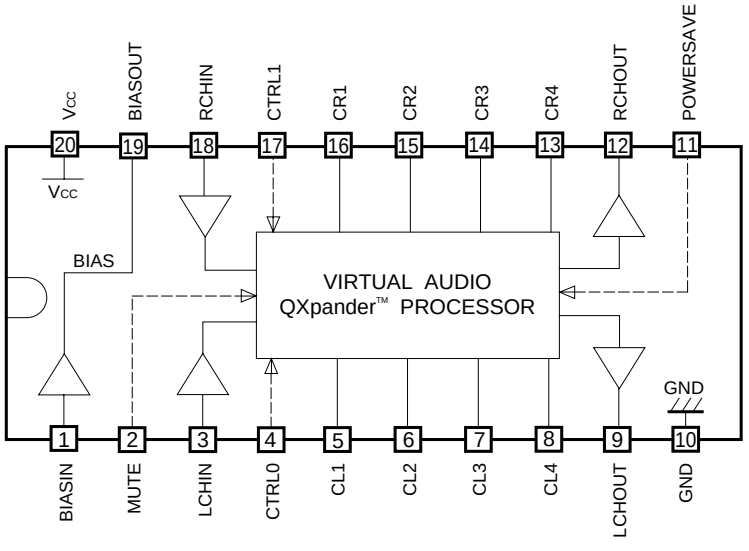
●Applications

Speaker systems for desktop and notebook multimedia personal computers, televisions, audio equipment, video games and other devices

●Features

1) Virtual 3D sound from ordinary audio signals.
2) No special encoding signals are necessary.
3) Three enhanced modes:
   QX1: Pro Listening
   QX2: Wide Listening
   QX3: Wow for Games
4) Internal functions for personal computers: power saver function, output muting function and stereo bypass function.
5) TTL-compatible control pins (at 5V).
6) Low noise (45μV_{rms})
7) Low power consumption
8) Available in SSOP-A20 pin package or SDIP22 pin package.

●Block diagram



Note:The above diagram is for the QX2130FS (SSOP - A20 package)

●Absolute maximum ratings (Ta = 25°C)

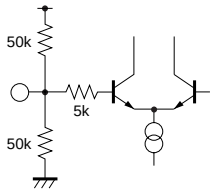
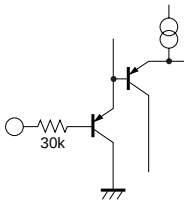
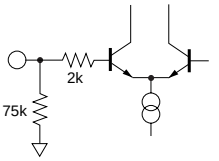
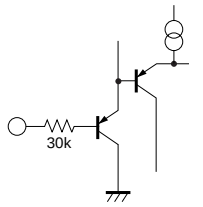
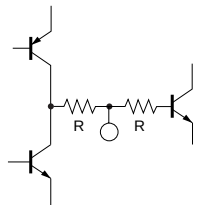
Parameter	Symbol	Limits		Unit
Power supply voltage	V_{CC}	13		V
Power dissipation	Pd	QX2130FS	1000*1	mW
		QX2130S	750*2	
Operating temperature	Topr	0 ~ + 70		°C
Storage temperature	Tstg	– 55 ~ + 125		°C

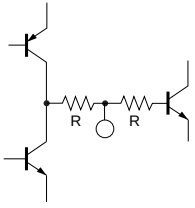
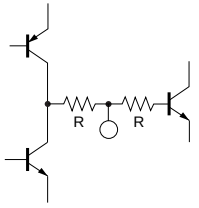
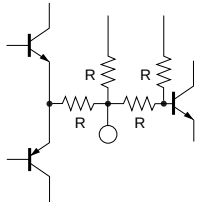
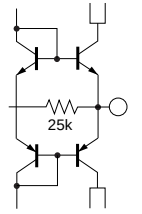
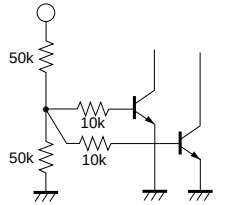
*1 When mounted on a 90 × 50 × 1.6mm glass epoxy board
Reduced by 10.0mW for each increase in Ta of 1°C over 25°C.
*2 When mounted on a 90 × 50 × 1.6mm glass epoxy board
Reduced by 7.5mW for each increase in Ta of 1°C over 25°C.

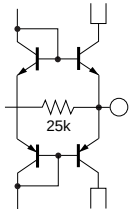
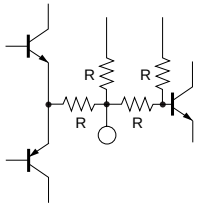
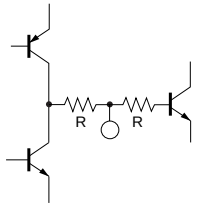
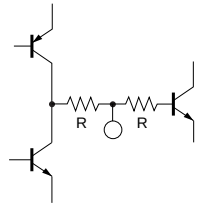
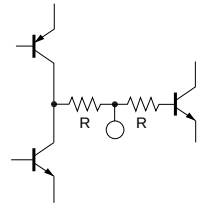
●Recommended operating conditions (Ta = 25°C)

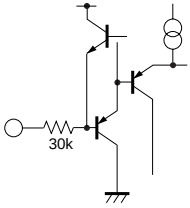
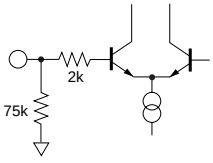
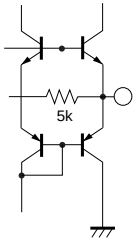
Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating power supply voltage	V_{CC}	4.5	—	12.5	V

●Input / output circuits (with QX2130FS)

1pin BIAS IN	2pin MUTE	3pin LCH IN	4pin CTRL0	5pin CL1
				

6pin CL2	7pin CL3	8pin CL4	9pin LCH OUT	11pin POWER SAVE
				

12pin RCH OUT	13pin CR4	14pin CR3	15pin CR2	16pin CR1
				

pin17 CTRL1	18pin RCH IN	19pin BIAS OUT		
				

●Analog characteristics (V_{CC} = + 5V DC, GND = 0V DC, Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
⟨Supply current⟩						
Supply current (QX mode)	$I_{CC}1$	1.3	3.0	5.2	mA	No signal Input
Supply current (stereo mode)	$I_{CC}2$	1.3	3.0	5.2	mA	No signal Input
Supply current (power saving mode)	$I_{CC}3$	—	230	500	μA	No signal Input
⟨Maximum input level⟩						
Maximum input level (QX3 mode)	$V_{INMax.}1$	– 8.3	– 5.3	—	dBV	V_{IN} = 100Hz V_{OUT}1% SINGLE channel INPUT
Maximum input level (QX2 mode)	$V_{INMax.}2$	– 7.6	– 4.6	—	dBV	V_{IN} = 100Hz V_{OUT}1% SINGLE channel INPUT
Maximum input level (QX1 mode)	$V_{INMax.}3$	– 7.4	– 4.4	—	dBV	V_{IN} = 1kHz V_{OUT}1% SINGLE channel INPUT
Maximum input level (stereo mode)	$V_{INMax.}4$	– 2.4	+ 0.6	—	dBV	V_{IN} = 1kHz V_{OUT}1% SINGLE channel INPUT
Maximum output level	$V_{OUTMax.}$	– 3.0	+ 0.5	—	dBV	V_{IN} = 1kHz V_{OUT}1% SINGLE channel INPUT
⟨Maximum mute level⟩						
Maximum mute level (QX mode)	VMUTE1	—	– 86	– 76	dBV	BW: DIN AUDIO V_{IN} = 1kHz, – 20dBV
Maximum mute level (stereo mode)	VMUTE2	—	– 97	– 87	dBV	BW: DIN AUDIO V_{IN} = 1kHz, – 20dBV
Channel balance	CB	– 1.5	0	+ 1.5	dB	V_{IN} = 600Hz, L + RIN
Output current	I_{OUT}	—	—	+ / –1	mA	—
Load resistance	R_L	10	—	—	kΩ	—
Load capacitance	C_L	—	—	1000	pF	—
Input impedance	R_{IN}	50	75	100	kΩ	—
Output impedance	R_{OUT}	—	—	200	Ω	—
⟨Distortion⟩						
Distortion (QX3 mode)	DSTN1	—	0.15	0.5	%	THD + NOISE V_{IN} = 1kHz, – 20dBV
Distortion (QX2 mode)	DSTN2	—	0.07	0.3	%	THD + NOISE V_{IN} = 1kHz, – 20dBV
Distortion (QX1 mode)	DSTN3	—	0.04	0.2	%	THD + NOISE V_{IN} = 1kHz, – 20dBV
Distortion (stereo mode)	DSTN4	—	0.02	0.2	%	THD + NOISE V_{IN} = 1kHz, – 20dBV
⟨Output noise voltage⟩						
Output noise voltage (QX mode)	VNOISE1	—	– 87	– 77	dBV	BW: DIN AUDIO R_g = 600Ω
Output noise voltage (stereo mode)	VNOISE2	—	– 98	– 88	dBV	BW: DIN AUDIO R_g = 600Ω
⟨Crosstalk⟩						
Crosstalk (stereo mode)	C_T	—	– 98	– 88	dBV	BW: DIN AUDIO V_{IN} = 1kHz, – 20dBV

∗ BW1: 400Hz – 30kHz (V_{IN} = 1kHz) , BW2: – 30kHz (V_{IN} = 100Hz)

(V_{CC} = + 12V DC, GND = 0V DC, Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
⟨Supply current⟩						
Supply current (QX mode)	$I_{CC}1$	2.0	4.9	12.0	mA	Quiescent
Supply current (stereo mode)	$I_{CC}2$	2.0	4.9	12.0	mA	Quiescent
Supply current (power saving mode)	$I_{CC}3$	—	560	1200	μA	Quiescent
⟨Maximum input level⟩						
Maximum input level (QX3 mode)	$V_{INMAX.}1$	+ 1.6	+ 4.6	—	dBV	V_{IN} = 100Hz V_{OUT}1% SINGLE channel. INPUT
Maximum input level (QX2 mode)	$V_{INMAX.}2$	+ 2.3	+ 5.3	—	dBV	V_{IN} = 100Hz V_{OUT}1% SINGLE channel INPUT
Maximum input level (QX1 mode)	$V_{INMAX.}3$	+ 2.5	+ 5.5	—	dBV	V_{IN} = 1kHz V_{OUT}1% SINGLE channel INPUT
Maximum input level (stereo mode)	$V_{INMAX.}4$	+ 8.0	+ 11.0	—	dBV	V_{IN} = 1kHz V_{OUT}1% SINGLE channel INPUT
Maximum output level	$V_{OUTMax.}$	+ 7.8	+ 10.8	—	dBV	V_{IN} = 1kHz V_{OUT}1% SINGLE channel INPUT
⟨Maximum mute level⟩						
Maximum mute level (QX mode)	VMUTE1	—	– 85	– 75	dBV	BW: DIN AUDIO V_{IN} = 1kHz, – 20dBV
Maximum mute level (stereo mode)	VMUTE2	—	– 97	– 87	dBV	BW: DIN AUDIO V_{IN} = 1kHz, – 20dBV
Channel balance	CB	—	0	—	dB	V_{IN} = 600kHz, L + R_{IN}
Output current	I_{OUT}	—	—	± 1	mA	
Load resistance	R_L	10	—	—	kΩ	
Load capacitance	C_L	—	—	1000	pF	
Input impedance	R_{IN}	50	75	100	kΩ	
Output impedance	R_{OUT}	—	—	200	Ω	
⟨Distortion⟩						
Distortion (QX3 mode)	DSTN1	—	0.16	0.5	%	THD + NOISE V_{IN} = 1kHz, – 20dBV
Distortion (QX2 mode)	DSTN2	—	0.07	0.3	%	THD + NOISE V_{IN} = 1kHz, – 20dBV
Distortion (QX1 mode)	DSTN3	—	0.05	0.2	%	THD + NOISE V_{IN} = 1kHz, – 20dBV
Distortion (stereo mode)	DSTN4	—	0.02	0.2	%	THD + NOISE V_{IN} = 1kHz, – 20dBV
⟨Output noise voltage⟩						
Output noise voltage (QX mode)	VNOISE1	—	– 85	– 75	dBV	BW: DIN AUDIO R_g = 600Ω
Output noise voltage (stereo mode)	VNOISE2	—	– 99	– 89	dBV	BW: DIN AUDIO R_g = 600Ω
⟨Crosstalk⟩						
Crosstalk (stereo mode)	C_T	—	– 98	– 88	dBV	BW: DIN AUDIO V_{IN} = 1kHz, – 20dBV

∗ BW1: 400Hz – 30kHz (V_{IN} = 1kHz) , BW2: – 30kHz (V_{IN} = 100Hz)

●Digital characteristics (V_{CC} = 4.5 – 5.5V DC, GND = 0V DC, Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
High level Input voltage	V_{IH}	2.0	—	5.0	V	
Low level Input voltage	V_{IL}	0.0	—	0.8	V	
I / O current, high level	I_{IH}	0.0	—	0.3	mA	$V_{IH} = V_{CC}$
I / O current, low level	I_{IL}	0.0	—	0.1	mA	V_{IL} = 0V

(V_{CC} = 5.6 – 12.5V DC, GND = 0V DC, Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
High level Input voltage	V_{IH}	2.5	—	5.0	V	
Low level Input voltage	V_{IL}	0.0	—	0.8	V	
I / O current, high level	I_{IH}	0.0	—	0.4	mA	V_{IH} = 5V
I / O current, low level	I_{IL}	0.0	—	0.1	mA	V_{IL} = 0V

●Measurement circuit

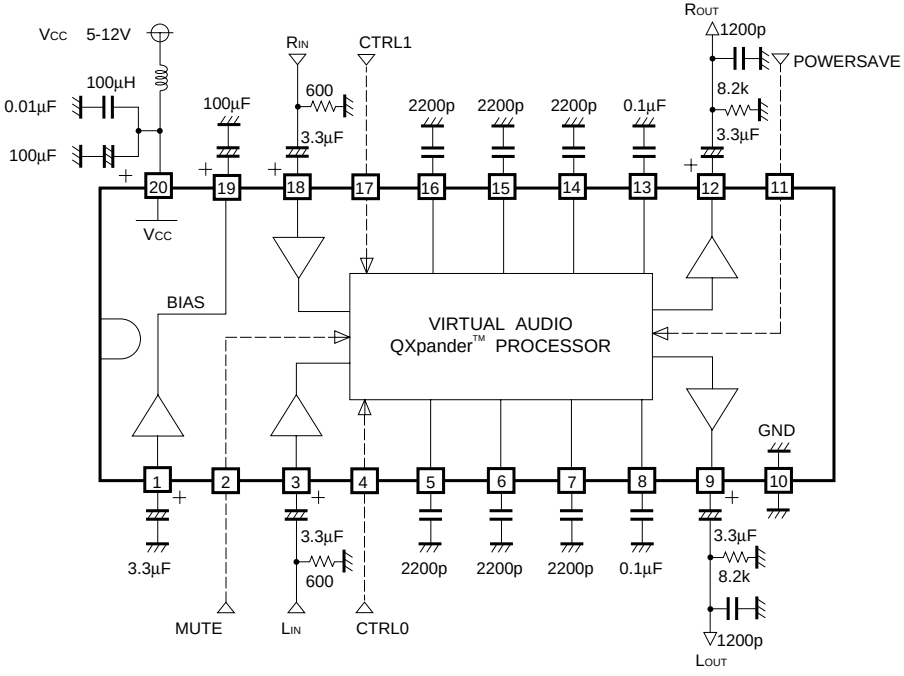


Fig.1

Unit: R (Ω)
C (F)
L (H)

Note: This diagram is for the QX2130FS (SSOP - A20 package) .

●Control mode

(1) CTRL0 & CTRL1 (pins 4 and 17)

CTRL0	CTRL1	MODE	FUNCTIONS	ENHANCEMENT
L	H	STEREO	Stereo Bypass	—
L	H	QX1	Pro Listening	Minimum
H	L	QX2	Wide Listening	Middle
H	H	QX3	Wow for Games	Maximum

(2) Mute (pin 2)

CTRL	MODE	FUNCTIONS
L	NOT Mute	Enabled Output (Lch / Rch)
H	Mute	Muted Output (Lch / Rch)

(3) Power saving mode (pin 11)

CTRL	MODE	FUNCTIONS
L	Active	Normal
H	Powersave	Shut Down

●Application example

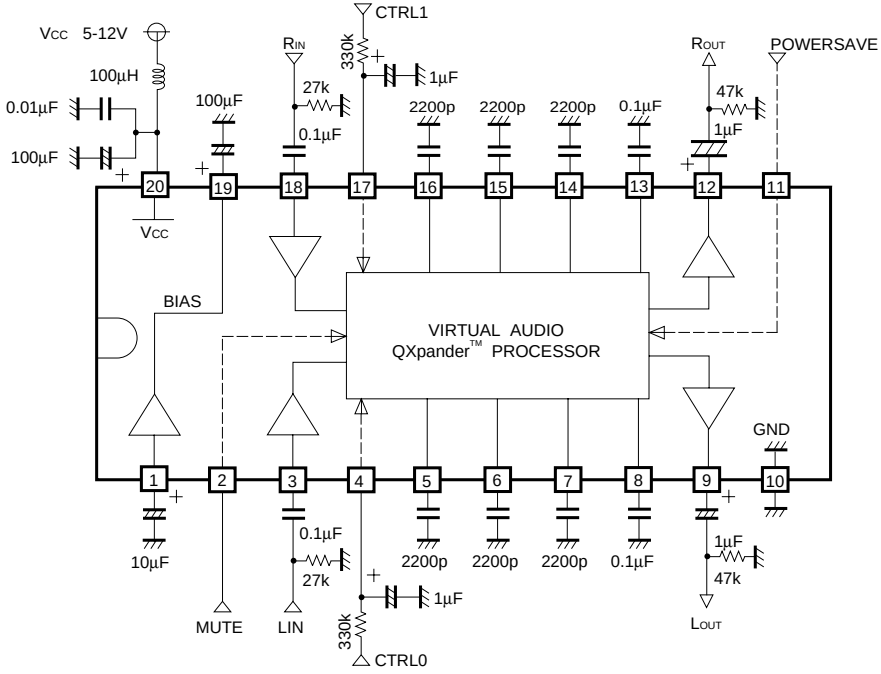


Fig.2

Unit: R (Ω)
C (F)
L (H)

Note:The above diagram is for the QX2130FS (SSOP-A20 package) .

●Operation notes

The QX2130FS and QX2130S were developed using technologies patented by QSOUND (U.S.A.) (patents 5,105,462 and 5,208,860), as well as other patented technologies (including related patents pending both inside and outside Japan). To use this IC, this technology must be licensed from QSOUND.

For inquiries concerning QSOUND™ licensing and technologies, contact:

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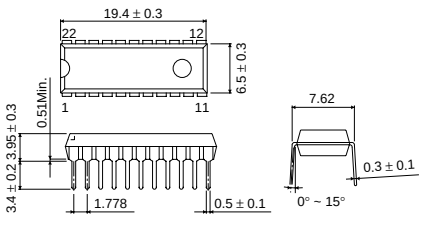
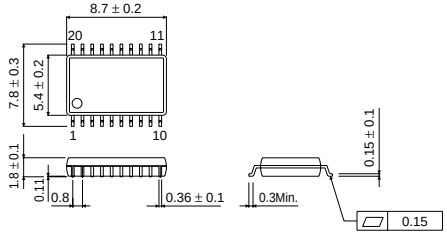
●External dimensions (Units: mm)



SDIP22



SSOP-A20